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AUTHOR	Jewett, Frank
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ABSTRACT

These instructions describe the use of BRIDGE, a computer software simulation model that is designed to compare the costs of expanding a college campus using distributed instruction (television or asynchronous network courses) versus the costs of expanding using lecture/lab type instruction. The model compares the projected operating and capital costs of the two types of campuses over a period of years, with cost projections based on the values of approximately 100 parameters that describe the general context of the simulation, and the resource requirements and associated costs of the lecture/lab and mediated campuses. The instructions provide a step-by-step guide to using the BRIDGE software, including the adjustment of default settings. Five appendixes provide information on the implications of various combinations of remote sites and campus course-sharing options, average section enrollment versus average annual enrollment, faculty salary calculations, distribution of faculty effort, and BRIDGE the web site. (MDM)

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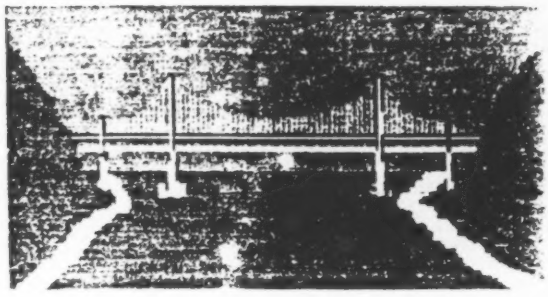
ED 430 426

BRIDGE:
A Simulation Model for Comparing the Costs of Expanding a Campus using Distributed Instruction versus Classroom Instruction

Documentation and Instructions



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The BRIDGE model is a component of a project entitled *Case Studies in Evaluating the Benefits and Costs of Mediated Instruction and Distributed Learning*. The project is funded through a Field-Initiated Studies Educational Research **Grant by the** National Institute on Postsecondary Education, Libraries, and Lifelong Learning, Office of Educational **Research and** Improvement, U.S. Department of Education (grant award no. R309f60088) with additional funding **provided by Information** Resources and Technology in the Chancellor's Office **of the California** State University. **The project is jointly sponsored** by the California State University, the National **Learning Infra**structure Initiative of EDUCAUSE, and **the State Higher** Education Executive Officers.

Frank Jewett, Director Research Projects, Information Resources and Technology
Chancellor's Office, California State University
P.O. Box 3842, Seal Beach, California 90740-7842
telephone: 562-985-9156 , e-mail <fjewett@calstate.edu>

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The idea for the BRIDGE model arose from a conversation with Edmund Cranch, Senior Fellow, New England Board of Higher Education. The structure of the model is based upon the project director's earlier work on the costs of year-round operation (*Year-Round Operation and the California State University*, CSU, Long Beach 1992). The programming and design of BRIDGE was accomplished by Désirée Davis. Sam Smolker assisted with final programming modifications. Alicia Campbell installed the program at the benefit cost project website.

An early version of BRIDGE was discussed at a systemwide meeting of the CSU Vice President and Provosts (Sacramento, October 1997). Versions of it have also been presented at several professional meetings: the National Learning Infrastructure Initiative (New Orleans, January 1998), Syllabus (Pomona and Sonoma, CA, March and July 1998 respectively), the State Higher Education Financial Officers (Newport Beach, August 1998), the CSU Media Directors (Tiberon, August 1998), and the Western Interstate Cooperative for Educational Telecommunications (Reno, October 1998). These discussions and presentations provided an invaluable sounding board that importantly affected the direction of the model's development.

Russell Utterberg's discussions with the author concerning how to initially structure the simulation were very helpful. Several individuals have reviewed BRIDGE and made valuable suggestions regarding its content and format, in particular, Frank Young, Mike McLean, and Gordon Smith (all from Information Resources and Technology in the CSU Chancellor's Office), Chuck Schneebeck from the Center for Distributed Learning at Sonoma State University, and last, but by no means least, members of the project's Steering, Review, and Oversight Committee: Tony Bates, Director of Distance Education and Technology, University of British Columbia; Dennis Jones, President of NCHEMS; Jim Mingle, Executive Director of SHEEO; Carol Twigg, Vice President (emeritus), EDUCAUSE, and Tom West, Assistant Vice Chancellor for Information Resources and Technology, CSU Chancellor's Office who not only provided critical comments and suggestions but also encouragement and support for the effort.

Frank Jewett

Contents

page

Acknowledgments ____ 2

BRIDGE - Documentation and Instructions ____ 4
1. Parameters ____ 4
   Default Values
2. Main Page - Changing Parameters ____ 5
   Final enrollment Distribution
   Course Sharing
   Course Enrollment
   Broadcast Course Specifications
   Asynchronous Network Course Specifications
   Graph
3. File Menu ____ 8
4. Parameters Menu ____ 8
   Broadcast Course Costs - Operating ____ 8
   Broadcast Course Costs – Capital ____ 9
   Asynchronous Network Course Costs - Production and Maintenance ____ 10
   Asynchronous Network Course Costs - Computer Related ____ 12
   Asynchronous Network Course Costs – Capital ____ 12
   Student Support Costs ____ 13
   Budget Expenditures ____ 14
   Campus Growth ____ 16
5. View and Print Menus ____ 17

Appendix A Notes on Remote Sites and Course Sharing ____ 18
Appendix B Average Section Enrollment in Broadcast Courses vs. Average Annual Enrollment in Asynchronous Network Courses ____ 19
Appendix C How a Fully Loaded Faculty Salary is Calculated ____ 20
Appendix D Distribution of Faculty Effort ____ 21
Appendix E Materials from the BRIDGE website ____ 22

Documentation and Instructions

BRIDGE is a simulation model designed to compare the costs of expanding a campus using distributed instruction (television or asynchronous network courses) vs. expanding using lecture/lab type instruction. The model compares the projected operating and capital costs of two campuses over a period of years. Both campuses are assumed to begin with same initial FTE, academic programs, and physical facilities. Both grow by the same amount of FTE over a given period of years. One campus accommodates all of its FTE in classroom-type (lecture/lab) instruction. The other campus accommodates its FTE in a changing mix of classroom, television/broadcast, and asynchronous network type courses. The values for initial (beginning) FTE, ending FTE, and the length of the growth or simulation period are specified by the user. The final mix of FTE for the mediated campus among classroom, broadcast and asynchronous courses is also specified by the user.

1. Parameters

The cost simulations produced by BRIDGE are based upon the values of approximately 100 parameters that describe the general context of the simulation (time period, growth, and mix of courses) and the resource requirements and associated costs of the "lecture-lab" and the "mediated" campuses. Users are encouraged to modify the parameter values: (a) to better describe their own particular situation and (b) to experiment with the model. Some of the more interesting parameter values from an experimental or "what if" perspective can be changed using the arrow buttons on the Main Page of the model as described below. The "Parameters" menu provides access to the other parameters not shown on the Main Page.

Default Values

BRIDGE contains a set of default parameter values that serve as a starting place for the model simulations. The default values are derived from a wide range of sources, some represent CSU systemwide averages, e.g., expenditures per FTE as shown in the "Budget Expenditures" window; others are based upon one or two observations, e.g., number of studio classrooms per control room as shown in the "Broadcast Course Capital Costs" window; and some are estimated from a set of assumptions that seem reasonable, e.g., the average number of hours per week a student enrolled in an asynchronous network course spends on-line as shown in the worksheet accessed via "Asynchronous Network Course Production and Maintenance Costs" window.

None of the default values should be interpreted as representing policy or a recommendation regarding the "correct" value of the parameter. At best, the default values represent observations of actual situations, at the least they represent estimates derived from a set of assumptions about which reasonable individuals might differ.

2. Main Page - Changing Parameters

(The following materials should be read while viewing the main screen of the BRIDGE model.)

The Main Page of BRIDGE appears following the BRIDGE title page and an introductory page entitled "What BRIDGE Does." The Main Page consists of a set of colored panels, a graph, and a set of pull-down menus. The contents of each is described below.

Final Enrollment Distribution (red panel)

The left side arrows on this panel determine the final distribution between lecture/lab courses and mediated courses for the mediated campus. For example, a 50/50 percent split between lecture/lab and mediated means that at the end of the simulation period, half of the campus FTE will be taught in lecture/lab format and half will be mediated. (This could also be interpreted as a campus with all of its courses offered as a 50/50 mix of mediated and lecture components).

The right side arrows determine the ending distribution of the mediated courses between broadcast and asynchronous network. The number shown is the percentage of the total campus FTE to be accommodated by each type. Through the use of these four arrows, any final combination of lecture/lab, broadcast and asynchronous network courses can be specified.

Additional enrollment specifications including initial FTE, ending FTE and the length of the simulation period can be accessed in the Parameters menu under "Campus Growth."

Course Sharing (dark green panel)

of campuses sharing: This is the number of campuses that have established an arrangement for sharing their mediated courses. The sharing arrangement is assumed to be completely reciprocal, i.e. each campus is providing the same number of courses to the sharing arrangement and that all mediated courses are being shared. For broadcast courses, this means that each sharing campus originates an equal percentage of courses (e.g., for 2 campuses sharing, 50 percent; for 3 campuses sharing 33 percent, etc.) and receives all the courses being broadcast from the other sharing campuses. For asynchronous network courses, each sharing campus contributes equally to the start-up and maintenance cost of all courses and all courses are then available to students at each sharing campus. (Appendix A contains a discussion of course sharing in conjunction with remote sites).

Course Enrollment (purple panel)

Average Section Enrollment (BC): The average section size of broadcast courses. Enrollment over the maximum studio enrollment is accommodated at remote sites or in on-campus classrooms receiving the broadcast. Average section enrollment is used to determine how many broadcast course sections

are needed each year to accommodate the specified amount of FTE in broadcast courses.

Average Annual Enrollment (AN): The average annual enrollment of asynchronous network courses. This is used to determine how many asynchronous network courses must be developed each year to accommodate the specified amount of FTE in asynchronous network courses.

Note: Average section enrollment for BC courses may be less than average annual enrollment because some BC courses may be repeated during the year. Since Broadcast costs are based on the number of broadcasts, average section enrollment is the appropriate parameter. An Asynchronous Network course that is produced and made available on a server does not have a section enrollment, only an annual enrollment. Thus a BC average section size of 50 is *not* equivalent to an annual AN course enrollment of 50. (Appendix B provides more discussion of this topic.)

Broadcast Course Specifications (dark red panel)

% of Position for preparing and presenting course: This is the percentage of a full-time faculty position assigned for preparing and presenting a broadcast course. If a full-time position teaches eight regular classroom courses per year on average, 1/8 or 12.5% percent of a position is allocated to a single course section. The percentage of a position allocated to a broadcast course may be different for several reasons. An instructor teaching a live broadcast class may need more time to prepare material. This can translate to an instructor being assigned fewer courses to teach in a given term or year, e.g., 7 or 6 or 5 or ... instead of 8 courses. Such assignments are represented by a larger percentage of a position, e.g., 17 if the annual course load is 6. The percent of position value entered here is applied to the fully-loaded faculty salary to determine the average instructor cost for preparing and presenting a single broadcast course. (Appendix C contains a description of how "fully loaded faculty salary" is calculated.)

Note: The "percent of position" value entered here does not include time spent outside of class interacting with students or evaluating student assignments or assigning grades. This latter cost is covered under the Parameters menu item "Student Support Costs" discussed below.

Distribution Cost: The average transmission cost of a course, this could be for satellite transmission, ITFS, local cable feed or two-way compressed video. (At the campus level, current means of television delivery are unlikely to provide sufficient channels to accommodate all the broadcast courses necessary to accommodate, e.g., 10,000 FTE.

Additional BC course specifications are found in the Parameters menu under "Broadcast Course Costs - Operating" and "Broadcast Course Costs - Capital."

Asynchronous Network (Course) Specifications (green panel)

Course Production Cost: The cost of designing, developing, and producing an asynchronous network course. This parameter includes a broad range of costs for subject matter faculty, instructional design professionals, media professionals, computing specialists, copyright clearance, and specialized equipment (e.g., for ADA compliance). (It could also be interpreted as an initial licensing fee for courseware provided by a third-party.) Basically, course production cost represents the initial costs involved in making an asynchronous course available to students. This parameter value can be changed from the Main Page. A detailed estimate of this amount can also be made using an ancillary workbook that is accessed via the "Asynchronous Network Course Costs - Production and Maintenance" option under the parameters menu. In general, asynchronous network course production cost should not be set above $1 million.

% work off-campus: The amount of computer work students in asynchronous courses do on their own computers with their own internet service providers. Students who own computers may also use campus computers. If, for example, 75 percent of the students owned computers, only 70 percent of their computer work may be off-campus. Student computer work done on-campus is assumed to be in open computer access facilities on equipment provided by the campus. Student computer work includes time spent connected to the server as well as time working off-line, writing papers, working on spreadsheets or any other work that would involve the use of a computer by the student.

Additional AN course specifications are found in the Parameters menu under "Asynchronous Network Course Costs - Production and Maintenance," Asynchronous Network Course Costs - Computer Related, and "Asynchronous Network Course Costs - Capital."

Graph (blue panel)

Clicking one of the three buttons on this panel sets the graph to display Operating (support) Costs, Capital Costs, or Total (both) Costs. Capital Costs are somewhat difficult to see on the display because they are small relative to Operating Costs. The title of the graph changes to indicate which of the three cost alternatives is being displayed. The graph displays the number of years in the simulation period along the horizontal axis. The beginning and ending values of FTE are displayed at the bottom of the graph.

3. File Menu

About this Program - Returns to the title page.

Getting Started - Returns to the introductory page "What BRIDGE Does."

Quit - Initiates a "save" prompt and quits the program.

4. Parameters Menu

Parameters Menu: Broadcast Course Costs - Operating

The parameters in this window relate to the operating costs involved in producing and distributing a live course in a studio classroom.

In-Studio Operating Costs

Studio cost/hour (including staff): The average hourly cost for a studio classroom. Factors included here are the cost of a videographer or other technical staff, lease costs (or equivalent) for the studio, basic studio operating expenses (electricity, etc.) and overhead. The course cost estimate is based upon a three semester unit course requiring 45 hours of transmission time.

Engineer cost/hour: The average hourly rate for control room functions including set-up, testing, and establishing connections; monitoring, and maintaining the transmission of all programming originating from the studios within the purview of the control room.

Other costs: Any other costs or adjustments for a single BC course section.

Remote Site Costs

These are the costs involved in the operation of off-campus sites that receive broadcast transmissions.

Remote Sites?: "Yes" indicates that remote sites are used to accommodate all student enrollments beyond the maximum studio enrollment. "No" indicates that all enrollment above the studio enrollment is receiving the broadcast in campus buildings. (See Appendix A for discussion of Remote Sites in conjunction with course sharing.)

Monitor pay/hour: The average hourly rate paid to a site monitor to maintain the site while it is receiving a transmission.

Site Lease Cost: The average cost of leasing a site for 45 hours per term (three hours a week for one semester). If the site is used for several courses, the amount entered is the *pro rata* share of the total lease costs attributed to one course.

Enrollment/site: The average course enrollment at a single remote site.

Note: Default Settings in the Parameters Menu

To facilitate user experimentation without losing the model's "starting place," each window in the Parameters Menu has three buttons that relate to parameter default values as follows:

SET AS DEFAULT	This button sets the parameter values displayed in the window as the defaults.
DEFAULT	This button resets the parameters in the window to the previously selected default values (these are either the user determined values selected by using the "set as default" button or the original defaults programmed into BRIDGE).
RESTORE DEFAULTS	This button restores the original default values programmed into BRIDGE, i.e., it over-rides values selected by the "set as default" button.

Parameters Menu: Broadcast Course Costs - Capital

The parameters in this window relate to the capital costs necessary to provide facilities to produce and distribute a television based course.

Studio conversion cost: The cost of converting a classroom into a broadcast-capable studio including all needed equipment. (The default value is based upon an estimate of CSU conversion costs.) Although conversion of regular classrooms is a fairly common practice, an estimate of new construction cost could also be used here.

Control room cost: The cost of converting space into a control room capable of monitoring the broadcast signal of multiple studio classrooms. (The default value is based upon an estimate of CSU conversion costs.) Again, an estimate of new construction costs could also be used here.

Maximum studio enrollment: The average number of stations available in studio classrooms. All BC course section enrollment over this number is assumed to be accommodated either at remote sites or in other rooms on campus.

Studios per control room: The maximum number of studios a single control room can monitor simultaneously.

Parameters Menu: Asynchronous Network Course Costs - Production and Maintenance

The two EXCEL worksheets accessed from this menu item ("ProfPos" and "ANCrs$") are structured differently than the other parameter windows in order to provide greater flexibility in setting the cost factors that determine the AN course costs used in the model. Use of these two sheets is optional since Asynchronous Network course production costs can be changed directly from the main screen. Using the arrows on the main screen does not affect the numbers on these pages. (However, clicking the "use this number in BRIDGE" button located on the ANCrs$ worksheet will transfer the worksheet cost estimate to the window on the Main Page.)

These two worksheets can be unprotected by using the password provided at the bottom of "ProfPos. Care should be exercised, however, in modifying the sheets to insure that the link to the main page not be lost.

Professional Positions per Course Lesson Hour (Worksheet tab "ProfPos")

The first sheet calculates the number of professional positions required to create a single asynchronous network course. This includes both faculty and media specialists. User defined inputs are shown in **boldface** numbers on the worksheet.

The worksheet is divided into three sections:

The first section specifies the number of work days that constitute a work year for regular full-time faculty and for media/computer professionals.

The second section contains the distribution of a typical student's time spent on a series of activities related to a single asynchronous network course. From this the number of on-line lesson hours (plus tests and examinations) is derived.
Note: The weekly time distribution sums to nine hours in accordance with the standard accreditation requirement that a three unit 15 week semester course requires a nominal 135 hours of student work (at 9 hours per week).

The third section calculates the number of positions needed to design and produce an asynchronous course based upon the number of workdays needed to create an hour of interactive lesson time. The number of positions is carried over to the second worksheet.

Asynchronous Network Course Production Cost Estimates (Worksheet tab "ANCrs$")

The second sheet calculates the costs of the professional positions derived on the "ProfPos" sheet and allows for additional costs related to producing course materials for on-line use.

Faculty Annual Position Cost: This is the fully-loaded faculty salary, computed elsewhere in the model. (For a detailed description of how this value is calculated, refer to Appendix C.)

Media/Computer professional annual position cost:
Support and Technical staff annual position cost: Annual salaries for each category (may include fringe benefits).

Support and Technical positions as share of professional positions: Support and Technical positions are calculated as a share of total professional positions (i.e., faculty & media/computer professionals)

Operating expenses as share of professional cost: The percentage of professional salary costs added for operating expenses.

Administrative overhead as share of professional cost: The percentage of professional salary costs added for administrative overhead

Other user determined costs include:
Copyright clearance
Specialized equipment
Software license fees, and
Other costs not elsewhere identified.

Based upon the course and cost parameters provided on the two worksheets, a total estimated (course) production cost is calculated. (This estimated cost value can be entered into BRIDGE by clicking the "Use this number in BRIDGE" button located on the worksheet).

Estimated useful life of course material (years): This is an estimate of the life expectancy of the course material, the time in years when the course materials are obsolete and should be completely replaced. In the model this value is used in conjunction with the initial production cost to generate an annual maintenance cost, e.g., a course with an initial production cost of $200,000 and a five year life generates an annual maintenance cost of $40,000 to provide for annual modifications and updates and allow complete replacement of all materials every five years.
Note: Estimated useful life can be manipulated to deal with courseware leasing situations as follows:

(a) If there is a fixed annual lease cost, enter the lease cost as the production cost on the main page and set the useful life to one year.

(b) If there is an initial "set-up" fee and an additional annual fee, enter the set-up fee as the production cost and set the course life as the quotient of the set-up fee divided by the annual fee. E.g., for a $90,000 set-up fee and a continuing fee of $15,000, the production cost is $90,000 and the course life is 6 years.

Parameters Menu: Asynchronous Network Course Costs - Computer Related

The parameters in this window relate to the computer costs involved in producing and distributing a true "any time, any place" asynchronous course. This may involve an Internet web page, a CD-ROM, a series of videotapes or some combination of these media.

Server hours/week/student: The average hours per week one student enrolled in one asynchronous course spends connected to and working on the server for course related activities. This estimate of student load is a component used to generate total weekly server demand.

Computer hours/week/student: The average hours per week one student enrolled in one asynchronous course spends using a computer for course related activities. This value includes server hours and "stand alone" hours. This value, in conjunction with "percent of work off-campus" which is set on the Main Page, is used to determine the amount of on-campus computer access that will be required for the asynchronous courses.

Lab monitor pay rate/hour: The average hourly rate paid to a monitor to supervise a computer access facility.

Peak server load (%): The greatest share of weekly server demand that is likely to occur in any hour. This value is used to determine total server capacity.
Note: A uniform load of 2.5 percent could be accommodated in a forty hour weekly period. Since servers typically operate 24 hours a day seven days a week, a peak load of 2.5 percent is probably a maximum.

Networking cost table (this table is accessed by clicking on the Networking cost table check box found in the dialog window.) The table displays the costs involved with operating a server. Increases in peak load require more server capacity and operating staff. Staff includes a web master as well as maintenance personnel. It is assumed the servers are leased.

Peak load: The largest number of students accessing the server at any given time.

Lease costs: The annual lease cost for the required server capacity.

Staff/operating expense The annual cost of staffing the server(s).

Note: Default values for lease costs and staff and operating expenses are based upon CSU estimates..

Parameters Menu: Asynchronous Network Course Costs - Capital

The parameters in this window are the capital costs for providing on-campus computer access for students enrolled in asynchronous network courses. As discussed above, the demand for on-campus computer access is determined

by the percent of student computer work performed on campus and the average computer hours per week per student per course.

Remodel cost per station: The cost, per computer station, of remodeling a typical classroom for use as an open computer access facility. This includes construction and project management costs, security systems, furniture, and cable costs. New construction cost estimates can also be used here.

# of stations: The average number of student computer workstations in a computer access facility.

Cost of computer: The cost of one desktop computer including associated hardware, software, and a share of printer and scanner access.

Note 1: The default values for remodeling and computer costs are estimates based upon CSU experience.

Note 2: If "% of (student) work off-campus" on the Main Page is set at 100 percent, BRIDGE assumes no on-campus computer access facilities are needed.

Parameters Menu: Student Support Costs

The parameters in this window refer to the costs associated with an individual student enrolled in one mediated course.

% Faculty Workload Devoted to Student Related Activities: The percentage of faculty effort allotted to student related instructional activities. This effort includes individual meetings with students (e.g. during office hours), telephone conversations, reading and responding to e-mail or message board postings from students, reading and grading assignments, term papers, and examinations; and assigning final grades. This parameter can be estimated from faculty activity studies as shown in Appendix D. The percentage is used in conjunction with the fully-loaded faculty salary (see Appendix C) and the student faculty ratio of the lecture/lab campus to determine the faculty cost of student interaction and evaluation activity on a per student basis.
Note 1: This value is entered as a whole number, not a decimal fraction, e.g. 33 percent is entered as 33 not .33.
Note 2: The calculation of faculty cost for student interaction and evaluation per student enrolled in a mediated course is made as follows - assume the fully loaded faculty salary is $87,165, the student faculty ratio of the lecture/lab campus is 19.5, and, based upon activity surveys for teaching in classroom mode, faculty devote approximately one-third of their instructional efforts to student interaction and evaluation activities. A full-time faculty member teaching classroom courses has, on average, 195 course enrollments per year (assuming all courses are 3 units, 19.5=(3 x total course enrollment)/30). Taking one-third of the salary to correspond to one-third of the effort gives $29,055, or $147.51 per student.
Note 3: Entering a student related workload percentage equal to that observed for classroom instruction will fund the same amount of effort for student related activities for mediated instruction as for classroom instruction.

Entering a percentage greater than that observed for classroom will generate more funding and effort for student related activities for mediated instruction.

Communication cost: The average cost of communicating with one student enrolled in one mediated course. This may include a pro rata share of the cost of an 800 number, the cost of mailing materials to off-campus students, or the cost of a message service for student calls during off hours.

Access to Information Services: The cost per student enrolled in one mediated course sustained by the library/and or media center to provide student access to information and data. This may include the cost of specific copyright clearance and the cost of processing and shipping library materials to off-campus students.

Other costs: Any other costs incurred by the campus per student enrollment in a mediated course.

Student fees: The amount charged, if any, to a student enrolled in a mediated course.

Total support cost per student enrollment in a mediated course is faculty interaction and evaluation cost plus communications cost plus access to information services cost plus other costs less student fees.

Parameters Menu: Budget Expenditures

The parameters in this window represent expenditures per FTE in the four main budget program categories: Instruction, Academic Support, Student Services, and Institutional Support. These values are used without modification to project the costs for the lecture/lab campus and, as described below, are adjusted to project some of the costs of the mediated campus.

Operating (Support) Expenses

Instructional cost/FTE: This is the cost of the instructional program per FTE. It is derived from campus instructional program expenditure data and total reported FTE. For the mediated campus this per FTE cost is eliminated for the mediated component of FTE because the costs of FTE in the mediated courses are computed in BRIDGE based on the type of course and the cost parameters entered in the program (i.e., on the Main Page and on the parameters menus as discussed above).

Academic Support cost/FTE: This is academic support program expenditures divided by the total FTE.

% (of Academic Support Costs/FTE) retained for Mediated Instruction: For the mediated campus, some of the regular academic support operation costs are covered by the cost parameters specified for the mediated courses (e.g. media and computing costs). In order that these costs not be counted twice, they are removed from the Academic Support component for mediated FTE.

The 78 percent default parameter represents removal of all of the media center costs and half of the computing costs in the Academic Support category as reported in CSU expenditure data for 1995-96.

Student services cost/FTE: This is student services program expenditures divided by total FTE. The same value is used for both lecture/lab and mediated instruction on the rationale that students already deal with student services at a distance.

Institutional support cost/FTE: This is institutional support program expenditures divided by total FTE.

% (of Institutional Support/FTE) retained for Mediated Instruction: This adjustment has the same rationale as provided above for Academic Support Costs/FTE. The 98 percent default parameter represents removal of half the communications costs in the Institutional Support category as reported in CSU expenditure data for 1995-96.

Capital Expenses

Capital expenditures represent the costs of adding new buildings, facilities and equipment to accommodate enrollment growth. The default values were derived from an extensive study of CSU capital cost data distributed among the various categories of instructional and non-instructional space and equipment.

Instructional cost/FTE: The cost of adding additional classroom, laboratory and other special instructional use space on a per FTE basis. This cost is used directly to project capital costs for the lecture/lab campus. For the mediated component of FTE at the mediated campus, it is only used for broadcast television courses if the remote site option is not selected. Both BC and AN courses have their own provision for capital costs based upon the FTE that is projected for them.

Non-instructional cost/FTE: The cost of adding non-instructional space – offices, support program space – on a per FTE basis. This cost factor is used to project capital cost for both the lecture/lab and mediated campus on the rationale that both require support space.

Group II instructional cost/FTE: The cost of portable instructional equipment on a per FTE basis. This cost factor applies only to the lecture/lab campus. Equipment costs for mediated instruction are included in the capital costs of the BC and AN courses.

Group II non-instructional cost/FTE: The cost of portable non-instructional equipment on a per FTE basis. This cost factor is used for both the lecture/lab and mediated campus on the rationale that both require equipment in their support space.

Other cost/FTE: The cost of minor capital outlay projects on a per FTE basis.

Student/Faculty Ratio: This is the FTE per faculty position in Year 0. It is the staffing ratio applied to all lecture/lab FTE. For the lecture lab campus the student/faculty ratio is held constant throughout the simulation period.

Parameters Menu: Campus Growth

The parameters in this window determine the size of the campuses being simulated. Several other parameters are also available here.

Growth Parameters

Initial FTE: The initial value of FTE for the two campuses (must be greater than zero).

Increase in FTE: The total amount of FTE growth during the simulation period. Initial FTE plus Increase in FTE gives the size of the campuses at the end of the simulation period.

Years to grow: The number of years the simulation covers. Years can be set between 1 and 50 using the slider bar. Since significant growth and implementation of new technology can only occur over a period of several years, the most interesting time ranges are probably between 10 and 30 years. All growth is treated as linear, the same amount of FTE is added each year over the range of years being simulated, e.g., growth of 10,000 FTE over a twenty year period results in 500 additional FTE each year, 10,000 FTE over 30 years results in 333.33 additional FTE per year.

Note: Initial FTE and final FTE (initial FTE plus increase in FTE) are displayed on the graph on the Main Page. Years to grow determines the values shown on the horizontal axis of the graph.

Faculty training

This section provides an option to include the annual costs of a faculty training and development program.

Cost per year: The amount the mediated campus spends each year to train faculty in the methods and use of mediated instruction.

Years: The number of years the training program is in effect. The option to terminate the program after a given number of years is provided on the rationale that in future years new faculty coming to the campus will be more familiar with the instructional applications of electronic digital technology.

Discount Rate

Discount rate: This interest rate is used to calculate the present value of the projected expenditure streams as shown in the annual totals window (accessed from both the View and Print menus). For public institutions the interest rate on state general obligation bonds may be used. For private institutions, the cost of long term loans may be used.

5. View and Print Menus

View and Print Menus: Parameters - Provides a list of the parameters used in the simulation.

View and Print Menus: Annual Totals - Provides operating costs, capital costs, and total costs for the lecture/lab and mediated campus for each year of the simulation. The present value of the differences between the total costs of lecture/lab and the mediated campus is also shown.

View and Print Menus: Other Results - Provides a set of comparison data for the beginning and ending year on costs, student faculty ratios, the distribution of faculty positions among classroom instruction and the various activities elated to mediated instruction, and the number of mediated courses offered.

Print Menu: Graph - Prints the current graph displayed on the Main Page.

Note 1: The print options allow the user to specify a run name to identify different simulation runs.

Note 2: The Help menu button is a permanent fixture of EXCEL applications. It is essentially inoperative in BRIDGE.

Appendix A

Remote Sites & Course Sharing

The following table discusses the implications of the various combinations of remote sites and campus course sharing options.

Remote Sites?	Course sharing?	
	No (1 campus only)	**Yes** (2 or more campuses)
No	A single campus is broadcasting courses to its students. Some of those students are located in the broadcast studio, the rest are in campus-owned (not leased) rooms, most likely, other classrooms on campus. (This is logical but does not seem to be a very likely possibility.)	Each participating campus is broadcasting to its own students, who are located on campus, either in the broadcast studio or in other classrooms as well as sending the courses to another campus (or campuses). Students at the receiving campus(es) are located on-campus in classrooms equipped for receiving broadcasts from other campuses.
Yes	The campus is broadcasting the course to off-campus sites that must be leased and staffed by the campus. With no course sharing, all the students are enrolled at the institution originating the broadcast, regardless of where they are physically located.	Each campus is originating broadcasts, which are transmitted to remote sites, some of which are leased by the originating campus, and some of which are leased by the receiving campus. The only people actually on-campus are the students in the classroom studio of the originating campus. Students at the remote sites are enroiled in whichever campus leases that site.

Appendix B

Average Section Enrollment (BC) vs. Average Annual Enrollment (AN)

If one wishes to compare costs for asynchronous network courses with costs of broadcast courses, it may be necessary to adjust the section size of the broadcast courses to make them consistent with the average annual enrollment of the asynchronous courses. The adjustment is necessary because an asynchronous network course, available on a server, simply has an annual enrollment. Section size is not a useful characteristic from a cost standpoint.

Live broadcast courses, however, may be repeated either in a given term or across the academic terms of the year. If the broadcast course is repeated, it is offered in sections that do have meaning for cost calculation purposes, i.e., the cost for each set of live broadcasts associated with different sections of the course. If a live broadcast course is repeated one or more times in a given year, its annual enrollment is greater than its average section size.

This distinction is important for comparison purposes because from a curriculum perspective two campuses are similar if they are offering the same number of courses. Thus setting average annual enrollment for the asynchronous network courses equal to the average section size for the live broadcast course results in the same number of courses in both modes only on the assumption that no broadcast course is transmitted more than once a year. If some broadcast courses are offered as sections (offered more than once a year), average section size for broadcast courses is less than average annual enrollment.

The adjustment is accomplished in two steps:

(1) For a given broadcast course average section size, the equivalent annual course enrollment is the section size multiplied by the ratio of broadcast sections to broadcast courses (the average number of sections per course).

(2) Set the asynchronous network course annual enrollment equal to the broadcast courses annual enrollment as derived in (1) above.

For example, assume average section size for broadcast courses is 175, a total 483 sections are broadcast that involve 224 courses (some of the courses are single sections, others are multiple sections).

The ratio of BC sections to BC courses is 2.156 (the number of BC sections per BC course on average).

The average annual enrollment for BC courses is 175 times 2.156 or 377.3.

Appendix C

How A Fully Loaded Faculty Salary Is Calculated

A "fully loaded faculty salary" (FLFS) represents the costs of the entire instructional program per faculty position.

The FLFS used in BRIDGE is not direct input. It is derived from the Instructional cost/FTE and the lecture lab campus student/faculty ratio, both of which are user inputs on the Budget Expenditures menu.

FLFS is calculated as follows:

Instructional cost/FTE times FTE in Year 0 = Total Instructional Support Expenditures

FTE in year 0 divided by Student/Faculty Ratio = total number of faculty positions

FLFS = Total Instructional Support Expenditures (less 2% for equipment) divided by faculty positions.

The calculation has the effect of allocating all Instructional program costs (faculty salary, clerical, departmental administration, and operating) to faculty positions. The same factor is used to calculate faculty costs for both the lecture/lab and the mediated campus. This insures that faculty positions are supported at the same rate at both campuses.

Appendix D

Distribution of Faculty Effort

The following material has been extracted from K. C. Green, "1994 Teaching, Technology and Scholarship Project Faculty Survey." The data have been rearranged and grouped by the author to better conform with the format of the BRIDGE model.

Activity	Average hours/week	Percentage distribution	Average hours/week Aggregated	Percentage distribution Aggregated
Teaching	9.84	17.63	9.84	17.63
Preparation			11.72	20.99
Course prep.	9.83	17.60		
New course prep.	1.89	3.39		
Student related			11.62	20.81
Time with students	6.00	10.74		
Grading, evaluating student work	5.62	10.07		
Research & related			11.16	19.99
Research/scholar.	7.55	13.52		
Consulting	1.59	2.85		
Professional assn.'s	2.02	3.62		
Service			11.49	20.58
Committees	4.26	7.63		
Other admin.	5.27	9.44		
Community serv.	1.96	3.51		
Total	55.83	100.0	55.83	100.0

n=2,903 CSU responses.

Appendix E

BRIDGE Website

(The following materials expand upon the materials at the BRIDGE website: <www.calstate.edu/special_projects/>)

BRIDGE Version 1.0

BRIDGE is a simulation model designed to compare the costs of expanding a campus using distributed instruction (television or asynchronous network courses) vs. expanding using lecture/lab type instruction. The model compares the projected operating and capital costs of two campuses over a period of years. Both campuses are assumed to begin with same initial FTE, academic programs, and physical facilities. Both grow by the same amount of FTE over a given period of years. One campus accommodates all of its FTE in classroom-type (lecture/lab) instruction. The other campus accommodates its FTE in a changing mix of classroom, live broadcast, and asynchronous network type courses. The values for initial (beginning) FTE, ending FTE, and the length of the growth or simulation period are specified by the user. The final mix of FTE for the mediated campus among classroom, live broadcast and asynchronous courses is also specified by the user.

Parameters

The cost simulations produced by BRIDGE are based upon the values of approximately 100 parameters that describe the general context of the simulation (time period, growth, and mix of courses) and the resource requirements and associated costs of the "lecture-lab" and the "mediated" campuses. Users are encouraged to modify the parameter values: (a) to better describe their own particular situation and (b) to experiment with the model. Some of the more interesting parameter values from an experimental or "what if" perspective can be changed using the arrow buttons on the Main Page of the model as described below. The "Parameters" menu provides access to the other parameters not shown on the Main Page.

Default Values

BRIDGE contains a set of default parameter values that serve as a starting place for the model simulations. The default values are derived from a wide range of sources, some represent CSU systemwide averages, e.g., expenditures per FTE as shown in the "Budget Expenditures" window; others are based upon one or two observations, e.g., number of studio classrooms per control room as shown in the "Broadcast Course Capital Costs" window; and some are estimated from a set of assumptions that seem reasonable, e.g., the average number of hours per week a student enrolled in an asynchronous network course spends on-line as shown in the worksheet accessed via "Asynchronous Network Course Production and Maintenance Costs" window.

None of the default values should be interpreted as representing policy or a recommendation regarding the "correct" value of the parameter. At best, the default values represent observations of actual situations, at the least they represent

estimates derived from a set of assumptions about which reasonable individuals might differ.

Download a copy of BRIDGE

You can download a copy of BRIDGE Version 1.0 and its accompanying documentation to run on your computer. The system requirements to run BRIDGE are Excel version 5 or later plus, for the Macintosh, the operating system must be OS 7.51 or later.

The model contains several screens and performs a large number of computations. It will run on computers with minimum configurations but is better suited for computers in the PowerMac and Pentium classes. Macintosh users with older machines must allocate at least 8192K to the EXCEL application. PC users must similarly recognize the memory constraint. Please be aware of the memory and concomitant speed limitations when running BRIDGE on older computers.

Two compressed files are available for that address the vast majority of computers:

- **To download BRIDGE for a PC, click here** PC
  After downloading you will have a file entitled BRIDGE.zip. Double click on the file and it will decompress into two files BRIDGE.xls and Bridge_DOC.pdf. Place both files in a folder named BRIDGE on your C:/drive.

- **To download for a MAC, click here** MAC
  After downloading you will have a file entitled BRIDGE.sit. Double click on the file and it will decompress into two files entitled BRIDGE and Bridge_DOC.pdf. Place both files in a folder named BRIDGE on your hard drive.

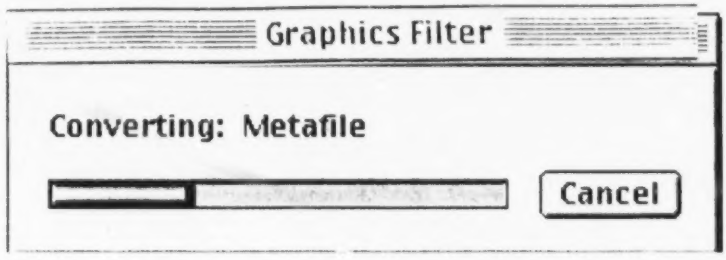
Running BRIDGE

The BRIDGE file should appear as an EXCEL spreadsheet icon that can be opened by double-clicking. If BRIDGE does not appear as an EXCEL spreadsheet, open the EXCEL application then open BRIDGE using the EXCEL *Open* command from the File menu. From then on, BRIDGE will be associated with EXCEL, will have an Excel icon and can be opened by double-clicking.

The file BRIDGE_DOC is in *pdf* format which means it is readable on any personal computer platform. This document contains useful information about the model and the definitions of the parameters.

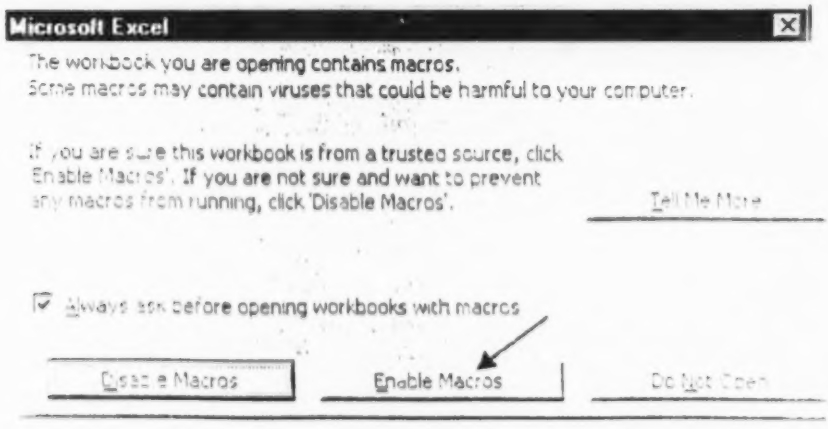
Explanation of Logon Displays

As BRIDGE is an EXCEL/Visual Basic application there are displays that may appear upon opening and quitting the program. During the initial open process the Macintosh user will see the following display flash on the screen:

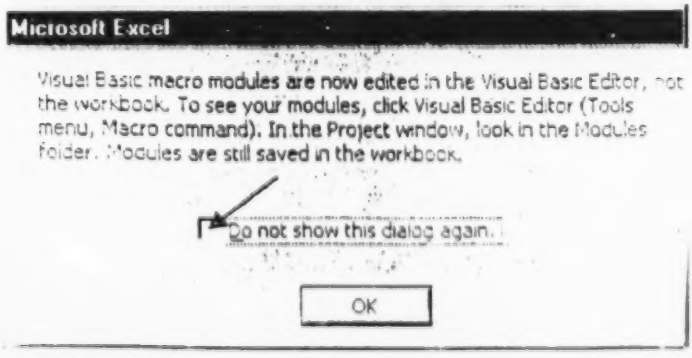


The two other displays are discussed below. We suggest that you allow the first one to appear and to eliminate the second.

(1) The Macros notification display will always appear unless the checkmark is removed. This is an Excel message and should not be disabled. When the screen is displayed, click Enable Macros. This is mandatory.


Microsoft Excel
The workbook you are opening contains macros.
Some macros may contain viruses that could be harmful to your computer.
If you are sure this workbook is from a trusted source, click 'Enable Macros'. If you are not sure and want to prevent any macros from running, click 'Disable Macros'.
Tell Me More
Always ask before opening workbooks with macros
Disable Macros
Enable Macros
Do Not Open

(2) The following information display may be inhibited from future logons by clicking the check box then clicking OK.


Microsoft Excel
Visual Basic macro modules are now edited in the Visual Basic Editor, not the workbook. To see your modules, click Visual Basic Editor (Tools menu, Macro command). In the Project window, look in the Modules folder. Modules are still saved in the workbook.
Do not show this dialog again.
OK

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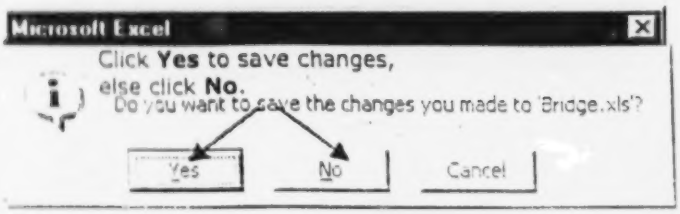
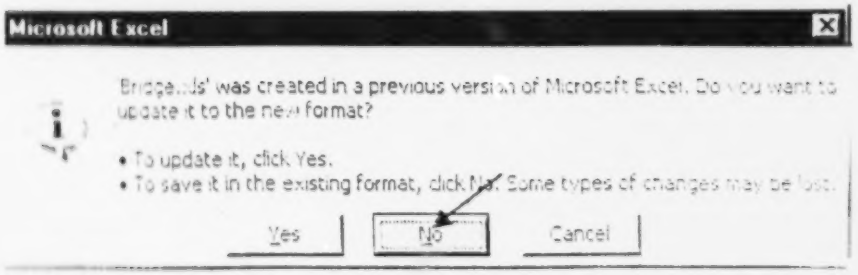
Explanation of Logoff Displays

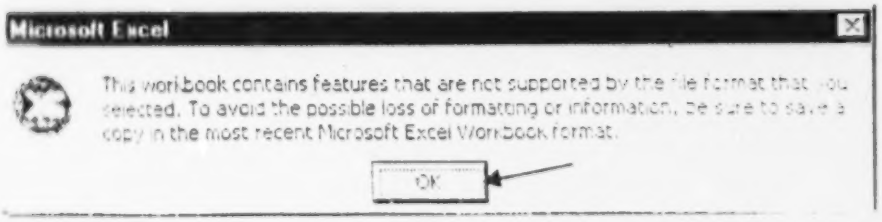
When you quit BRIDGE, you will receive a series of messages.

(1) The first is a Microsoft Excel message asking if you want to save changes. If you have made changes that you want to see upon opening the model the next time, click **Yes** else click **No**.



(2) If you clicked Yes on the "save changes" display, you will receive Microsoft messages asking if you want to save BRIDGE to a newer version of EXCEL and warning you when you don't. Respond **No** to the first and click **OK** on the second. Always save BRIDGE in the format in which it is downloaded from the web site.


Microsoft Excel
Bridge...ls' was created in a previous version of Microsoft Excel. Do you want to update it to the new format?
• To update it, click Yes.
• To save it in the existing format, click No. Some types of changes may be lost.
Yes
No
Cancel


Microsoft Excel
This workbook contains features that are not supported by the file format that you selected. To avoid the possible loss of formatting or information, be sure to save a copy in the most recent Microsoft Excel Workbook format.
OK

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Screen Resolution

For some computer and monitor configurations, it may be necessary to experiment with changing the screen resolution (e.g., change from 600x800 to 480x640, etc.) in order to best view BRIDGE.

Contacts

For conceptual questions regarding the structure and components of BRIDGE, contact:

Frank Jewett,
Chancellor's Office, California State University
e-mail: <fjewett@calstate.edu
telephone 562-985-9156

For questions regarding the programming that is used to display the results, contact:

Sam Smolker
Chancellor's Office, California State University
e-mail <sam_smolker@calstate.edu>
telephone 562 985 9074